MEASURING THE EFFECTIVENESS OF A VOLUNTEER EMERGENCY-MONITORING SYSTEM IN THE CITIZENS RADIO SERVICE

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This paper describes the experimental statewide emergency communications network utilizing the Citizens Radio Service conducted in Ohio during 1970-1971. A joint project of REACT National Headquarters and the Ohio State Highway Patrol, the program known as the Ohio REACT Emergency Network was established as an experimental 2-year program to test the effectiveness of volunteer citizens monitoring emergency communications and providing assistance to motorists in accordance with the Federal Communications Commission's establishment of channel 9 as the official emergency channel. A state director was appointed for REACT, and districts were established based on the Highway Patrol district boundaries. A district coordinator was appointed for both the Highway Patrol and REACT volunteers in each district to provide comparable levels of contact and authority. Log reports of calls received for emergencies and motorists' assistance are tabulated by computer at General Motors Research Laboratories. This paper describes the organization, presents the data gathered in the program's first year of operation, and establishes goals for the second year.

•THE FOLLOWING observation was made by William N. Carey, Jr., Executive Director of the Highway Research Board: "The problems of developing an integrated nationwide highway communications system are more political, institutional, administrative, and managerial than technical. Nothing significant will be done until we find effective approaches to the nontechnical problems." The need for such a system is best documented by the fact that, once given the means to communicate via two-way radio from their vehicles, individual citizens instinctively develop their own highway communications system. The REACT system mobilizes this grass-roots movement to overcome the "nontechnical problems."

The Ohio State Highway Patrol, REACT National Headquarters, and General Motors Research Laboratories concurred that the Citizens Radio Service (CRS) is now providing thousands of motorists with highway communications. Furthermore, CRS offers a vast potential for an integrated nationwide system in a relatively short period of time. It was also felt that the concept of two-way radio for highway safety communications from individual motorists to volunteer citizen monitors deserved serious evaluation.

The key question seemed to be, "How effective could this system be?" Effectiveness would be measured through relatively simple data acquisition with computer analysis to project the raw data into significant statistics. This paper summarizes the first year of the operation of the Ohio REACT Emergency Network, the purpose of which was to measure the effectiveness of a volunteer emergency-monitoring CRS system.

Sponsored by Committee on Communications and Committee on Motorist Services.

DEVELOPMENT OF CITIZENS RADIO SERVICE

As the 1950s came to a close, the Citizens Radio Service began. Putting two-way radios into ordinary passenger automobiles immediately produced the phenomenon that was potentially the key to a highway communications system.

Even with a single motorist in communication with his own base station, the concept of two-way radio for motorist assistance was in effect. As additional operators joined the citizens band ranks in a given community, they pooled their common interest into CB Clubs. One of the purposes of these clubs was to provide a means of emergency highway communications primarily to benefit the members of the group. Gradually, the reporting of accidents and stalled motorists and requests for various types of assistance from the highway were worked into a general pattern of emergency communications for the public as well. When local emergency situations arose such as fires, floods, tornadoes, hurricanes, snowstorms, or other serious conditions that curtailed ordinary telephone communications, the club was ready to serve community needs.

By 1962, the emergency communications potential of the CRS was well recognized by industry leaders. The possibility of providing a pattern for organized local emergency groups was recognized, and in that year REACT (Radio Emergency Associated Citizens Teams) was founded.

REACT is an entirely voluntary organization, and the individual groups agree to work toward a 24-hour monitoring system on channel 9 as part of their agreement with national headquarters. At the present time, approximately 40,000 active participants are organized into almost 1,000 local groups throughout the United States and Canada. Sponsorship of REACT was assumed 3 years ago by General Motors as a public service and as a highway safety research project (1).

As early as 1964, REACT required all of its teams to monitor a single channel, channel 9. All who needed assistance were encouraged to call on channel 9. Thus emerged the concept of a single national emergency channel.

REACT joined with other interested parties in petitioning the Federal Communications Commission to establish an official emergency channel on channel 9. The Commission acted favorably on this, effective July 24, 1970, by limiting the channel to "emergency communications involving the immediate safety of individuals or the immediate protection of property or communications necessary to render assistance to a motorist" (2).

Among the considerations the FCC took under advisement in establishing the official emergency channel was the prior voluntary use of the channel for emergency purposes. By 1969, thousands of volunteer monitors were handling emergency calls, with approximately two million radios in use. A REACT study showed that, as early as 1966, 1,800,000 incidents were handled annually on channel 9, including about 500,000 automobile accidents. In effect, what the FCC was doing was recognizing a de facto emergency channel that had developed through the wholly voluntary efforts of thousands of members of REACT and other individual licensees.

The key to this system is that people are listening and ready to help. This is how the REACT concept works: The motorist communicates his need for assistance to the REACT monitor on CB channel 9. The monitor contacts the proper service agency by telephone (police, fire, or road service). Finally, the REACT monitor reports the successful dispatch of assistance to the motorist on CB channel 9. The motorist then knows that help is on the way.

A pattern of research and official implementation of the emergency channel concept was already under way. The Detroit CB Radio Driver Aid Network was established in 1966 (3). It covers the metropolitan area of Detroit with a central monitor linked to strategically placed transmitter and receiver units by land line. After technical development by General Motors Research Laboratories, the system was turned over to the Detroit Department of Streets and Traffic for operation of the system. Tabulation of all calls received by the monitor has been made regularly and has been reported in previous papers.

A recent study of the Detroit network by the Civil Engineering Department of Wayne State University has brought out some additional data (4). A key product of this research was the time saved in reporting incidents. The study indicated that approxi-

mately 17 min could be saved in detection-reporting time by using the CRS on a city freeway as compared to waiting until a city police car or a county service vehicle appeared on the scene.

THE OHIO REACT PROGRAM

Before proceeding with a further description of the Ohio REACT program, it is appropriate that we review the various highway communications systems proposed. These include the following:

1. Visual distress signal such as a handkerchief on the automobile antenna or a raised hood,
2. Patrols of official vehicles—police and road service,
3. Headlight signaling,
4. Roadside call boxes,
5. Embedded sensors to detect traffic flow,
6. Roadside radio transmissions for in-vehicle audio or visual signaling or both,
7. Electronic vehicle locator system, and
8. Citizens two-way radio.

Although other means of communications are possible, these are very representative of the types of systems. Some are in actual use, and others are currently being tested and seriously considered singly, and in combination, for adoption on a national basis.

Because this paper deals only with citizens two-way radio, recognition of its relationship to other systems is important to the overall evaluation of results. Thus, by stating relative potentials, we can evaluate actual data with greater relevance. We will not attempt to evaluate all the possible systems in detail, but it is helpful to note the relative ability of the various systems to accomplish each of the following communication objectives:

1. Rush aid to accidents faster,
2. Keep traffic moving to prevent accidents,
3. Reduce walking on highway to seek assistance,
4. Report dangerous driving behavior or conditions to authorities,
5. Provide routing information for motorists, and
6. Provide emergency messages to the driver.

We believe that two-way radio inherently fulfills all of these objectives. The other currently proposed systems seem unable to provide this total capability.

A key advantage of citizens two-way radio is that the motorist makes the investment for the communications equipment involved. The motivation for such an investment is, to a great extent, the ability to communicate for personal and business uses other than in the emergency situation.

One of the difficulties with any communications system is convincing the motorist that an investment for purely emergency purposes is warranted. Thus, the desire for an in-vehicle device that is merely to receive special instructions from a highway control source, or for signaling an emergency, would not be as great as a general-purpose two-way radio, which in addition can be used for emergency communications.

Obviously, it would cost far less in terms of government funding to set up monitoring stations on an emergency radio frequency than to establish a national system of telephone or radio-telephone call boxes or to proceed with embedding sensors at major intersections either in the road or at roadsides. When the maintenance cost is added to the installation cost, a very expensive system is required in each case. In the REACT system, not only have we eliminated the equipment investment, but also our volunteer monitors appear on no payroll.

Recognizing the possibility of establishing a nationwide public monitoring system similar to the Detroit network, REACT proposed a research program that uses a limited geographical subdivision of sufficient size and complexity for the results to be projectable nationally. Ohio was selected for the following reasons:

1. It had many qualities of geography, topography, climate, highway types, and demography that could be projected nationwide;

2. The REACT structure in the state was reasonably well developed; and
3. The Ohio State Highway Patrol had some experience in working with CB radio groups and had exhibited willingness to cooperate with existing REACT teams.

In late 1969, REACT National Headquarters contacted the Ohio State Highway Patrol with the proposal for joint cooperation in a 2-year experimental program to study the ability of CB radio volunteer groups to provide an effective highway communications system (6). The State Highway Patrol agreed to cooperate in such a joint venture provided that REACT appoint a qualified state director to coordinate the program at the local level and that the Federal Communications Commission establish channel 9 as an official emergency channel at least for this program.

The terms were met when Frank Travis of Akron was appointed as the REACT State Director and by the previously mentioned Federal Communications Commission ruling establishing channel 9 nationwide as the emergency channel, effective July 24, 1970. That became the target date for launching the Ohio test program.

Organization for Ohio obviously required a higher level of sophistication than the broad-based national REACT structure, under which REACT National Headquarters directly charters local groups as REACT teams. It was evident that, for REACT to function effectively as a recognized emergency communications system, it was necessary to evolve more practical and standardized methods for local liaison, training, and operational techniques.

To solve these problems, the Ohio REACT Emergency Network was developed as a joint venture of the Highway Patrol and REACT National Headquarters. The Highway Patrol lent their prestige to the program as the key law enforcement agency in the state concerned with highway safety. To get the program under way, the Highway Patrol hosted two statewide meetings at the Patrol Academy in Columbus.

One meeting involved interested state officials representing the state highway department, the State Police Chiefs and Sheriffs Associations, the Ohio AAA, the Red Cross, Civil Defense, FCC, and the communications staff of the State Highway Patrol. The second meeting included representatives of all the REACT teams in the state.

Subsequently, joint meetings were held at each of the Highway Patrol District Headquarters with the existing REACT teams, other interested CB radio groups, and the key local law enforcement agencies in each district. The Highway Patrol appointed a volunteer REACT member in each district as coordinator to work with the communications technicians of the Highway Patrol who were assigned the responsibility of coordinating the program within the districts. Thus, at the end of the organizing phase of the program, the 60 REACT teams in the state were organized into 10 districts paralleling those of the Highway Patrol. The teams report to both the Highway Patrol and the REACT state director, all under the joint supervision of Patrol Headquarters and REACT National Headquarters (Fig. 1).

The value of this first round of meetings cannot be underestimated. All concerned parties were able to meet under favorable conditions at a Highway Patrol post to learn the objectives and procedures that were to be used in the program. With local police and sheriffs attending, the control of the program was firmly in the hands of law enforcement officials, with the volunteers directed to follow procedures acceptable to the authorities or risk losing official recognition.

Experiences bore out the effectiveness of this approach. Furthermore, bringing the local law enforcement agencies into direct contact with the volunteer groups at the Highway Patrol post has produced a higher level of cooperation between local officials and the volunteer groups than had heretofore been present.

A simple data gathering procedure was, of course, mandatory to effective evaluation of Ohio REACT. A standard report form was developed to permit simplified yet complete recording of information regarding each call received on the emergency channel by each REACT team monitor. In addition, a monitor guide was developed to provide instructions for the monitors. This was particularly important in view of special regulations established by the Federal Communications Commission governing the use of the official emergency channel.

The reports were to be collected by the individual teams and forwarded to General Motors Research Laboratories for tabulation by computer. These computer tabulation

reports were published and distributed to all interested agencies by REACT National Headquarters. Figure 2 shows the results of the tabulations.

Because the reporting monitors are volunteers, the chief difficulty has been to get reports of all the calls received. Nonetheless, in the first year's operation, 9,968 calls were recorded. For statistical purposes, we are considering the period from June 24, 1970, through August 1971 as 1 year. This compensates for reports lost at the start of the program and the lag in receiving reports for August 1971. The figures are interesting. When one considers that over 60 percent of the calls involved either an accident or immediate threat to highway safety (specifically, stalled vehicles or road obstructions), it is easy to see why police and highway officials are encouraged by what these civilian volunteers can accomplish. The 23.3 percent of the calls describing "other incidents" are being identified in greater detail during the second year of the program with a new reporting form that will permit far more detailed tabulation.

There are several observations we would like to make regarding what the teams are reporting. Fist, there is a large variation in the number of calls received by the various teams; in fact, a good many teams failed to report any calls. Obviously, some volunteer groups are much more effective than others. On the other hand, there seems to be a correlation between team reporting frequency and population. The three top teams in calls reported 36 percent of the total, whereas their coverage area (county) includes nearly 28 percent of Ohio's population.

Second, some of the teams reporting very few calls or none at all claim that they have reported all the calls they have received. Thus, there is some question of the extent to which channel 9 is being used for motorist assistance and to report emergency communications in various areas. Also, some teams claim that it is difficult to receive the calls on channel 9 in their area because of illegal interference from various sources.

Third, one highly favorable result is a healthy increase in total REACT teams—from 60 to more than 80 in the first year.

A recent survey completed by Advanced Technology Systems, Inc., under contract to the FCC, points out that illegal use is the most serious problem in class D citizens radio (6). The ATS report recommends the establishment of a substantial enforcement program to curb violations such as use of excess power, off-frequency operation, long-distance "skip" communications, failure to be licensed, and failure to use identifying call signs, and we would add enforcement of the emergency channel rule.

We note with concern that, from the effective date of the emergency channel, July 24, 1970, until the time that this paper was written, there have been no violations of the emergency channel rule cited by the FCC. In view of that situation, we believe that self-policing and compliance with the rule have been remarkable. The FCC-sponsored study also indicates that an expanded education program is required to achieve understanding and cooperation of licensees. ATS also pointed out that, in spite of all the problems, 47 percent of the licensees report use of CB for emergencies an average of 17 times per year.

A survey of all REACT teams conducted in October 1971 sheds some additional light on the achievements of the Ohio REACT program. Ohio teams now have a decidedly more favorable relationship with official agencies than does the average REACT team nationally (Table 1), and public safety officials are far more interested in monitoring CB in the improved climate of Ohio (Table 2).

CONCLUSIONS

The chief conclusion of this experiment is that there is a reasonable potential for a volunteer monitoring system for highway communications utilizing the Citizens Radio Service. In spite of all of the difficulties encountered, e.g., illegal operations, atmospheric phenomena, unpredictable coverage, and the irregularities inherent in a volunteer program, the Ohio REACT Emergency Network proves that a significant amount of highway emergency traffic and motorist assistance can be conducted on channel 9. Volunteers who are dedicated to service, trained, and willing to train others in effective communications techniques can be the backbone of a workable emergency and motorist assistance system.

Figure 1. Organization of the volunteer emergency-monitoring system.

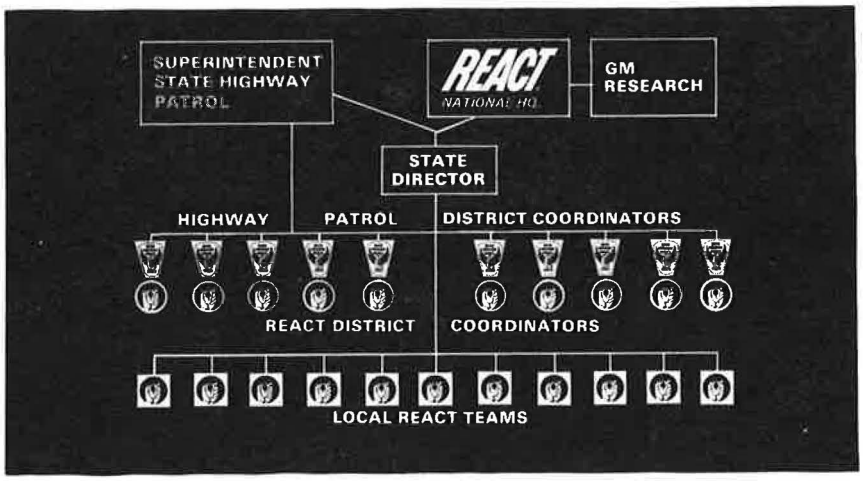

Figure 2. REACT log report.

FOR THE MONTHS OF:	JUN70	JUL70	AUG70	SEP70	OCT70	NOV70	DEC70	JAN71	FEB71	MAR71	APR71	MAY71	JUN71	JUL71	AUG71	CUMULATIVE TOTAL	CUMULATIVE PCT.
(BREAKDOWN OF REPORTS)																	
ACCIDENTS:	4	63	159	212	231	190	238	291	300	279	159	184	146	102	188	2826	28.4
. # OF VEHICLES	7	117	243	371	444	373	476	562	534	487	290	338	250	339	334	5165	
. WITH INJURY/S	1	14	27	55	41	29	40	33	35	40	29	43	27	37	39	490	
. WITH FATALITY/S	0	0	3	1	4	1	2	1	1	3	2	2	1	2	4	27	
REQUEST FOR INFO.	4	51	112	107	84	115	133	157	180	164	145	139	116	151	203	1861	18.7
STALLED VEHICLE	1	52	101	136	168	207	161	173	265	222	140	179	134	172	159	2270	22.8
ROAD OBSTRUCTION	2	24	46	81	60	43	55	63	95	85	51	73	69	66	58	871	8.7
FIRE	0	4	21	14	11	10	9	17	20	20	40	24	22	30	19	261	2.6
TORNADO	0	2	0	0	0	0	0	0	0	0	1	4	11	2	0	20	0.2
HURRICANE	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	
OTHER INCIDENT	1	79	179	141	168	178	161	202	209	165	139	153	146	175	222	2318	23.3
(ROAD CONDITIONS AND ACCIDENTS)																	
DRY PAVEMENT	1	37	103	133	125	81	96	71	41	86	130	138	119	105	130	1396	49.4
WET PAVEMENT	2	18	26	55	76	64	91	79	113	81	19	41	16	51	38	770	27.2
ICE AND/OR SNOW	0	0	2	3	5	32	41	156	138	119	1	1	1	1	1	501	17.7
FOG	0	0	5	4	5	4	6	4	7	5	1	1	0	5	1	48	1.7
OTHER ROAD COND.	0	0	3	3	6	5	6	3	7	2	0	1	0	0	0	36	1.3
ROAD COND:NO DATA	1	8	26	20	20	16	16	28	43	24	8	5	10	23	19	267	9.4
(ROAD TYPES AND ACCIDENTS)																	
INTERSTATE	2	20	50	55	59	61	71	107	95	87	48	59	45	58	54	871	30.8
FREEWAY	0	10	19	35	38	39	29	68	63	61	25	28	34	25	24	498	17.6
TOLL ROAD	0	3	0	0	0	0	0	2	1	0	0	2	2	3	0	13	0.5
BRIDGE	0	1	3	4	5	4	3	1	9	5	4	3	3	1	1	47	1.7
CITY STREET	0	15	61	89	88	72	111	78	85	82	54	66	46	61	75	983	34.8
SECONDARY ROAD	2	7	20	24	26	11	18	28	36	35	24	25	13	26	17	312	11.0
OTHER ROAD	0	10	14	13	13	9	8	2	10	7	6	4	3	5	5	109	3.9
ROAD TYPE:NO DATA	0	3	8	10	14	8	9	13	19	13	9	5	7	8	13	139	4.9
(AUTHORITIES NOTIFIED, EXCLUDING INFO. REQUESTS)																	
CITY POLICE	5	93	229	305	326	349	344	405	406	322	229	282	251	282	304	4132	51.0
SHERIFF	1	20	48	37	37	30	29	26	54	55	48	48	33	59	48	573	7.1
STATE PATROL	1	39	103	79	89	81	72	82	120	135	89	95	76	95	87	1243	15.3
FIRE DEPARTMENT	0	4	13	16	13	9	12	14	15	15	32	24	17	26	16	226	2.8
OTHER AUTHORITY	1	48	118	136	159	173	140	165	224	158	90	123	77	81	107	1800	22.2
AUTHORITY:NO DATA	0	19	39	35	50	56	66	69	67	72	50	69	69	102	82	845	10.4
(SOURCE OF CALL, EXCLUDING INFO. REQUESTS)																	
CALLER INVOLVED	0	18	34	30	36	28	25	56	54	48	21	32	24	42	28	476	5.6
PASSER BY	5	112	267	274	275	282	308	366	424	359	260	325	275	335	369	4236	49.6
REACT TEAM	3	39	102	139	150	185	141	180	208	211	161	170	146	163	156	2154	25.2
OTHER SOURCE	0	33	42	43	39	45	41	65	50	44	28	30	21	25	23	529	6.2
CALL ORGN:NO DATA	0	21	81	82	123	115	122	100	122	77	59	65	47	75	61	1150	13.5
REPORT TOTALS	12	251	592	638	675	739	738	865	995	870	646	745	614	768	820	9968	

Table 1. Working relationship with REACT.

Group	Nationwide (percent)	Ohio (percent)
Local police	70.6	65.2
Sheriff	63.7	71.7
State police	65.5	87.0

Table 2. Monitoring of CB channel 9 by public safety officials.

Group	Nationwide (percent)	Ohio (percent)
Local police	18.0	15.2
Sheriff	16.5	37.0
State police	13.7	60.9

The program demonstrated that two-way communications effectively provide the motorist with a means of communicating his problem in depth. It permits the helper, be he professional or volunteer, to determine the correct course of action to aid the motorist and report back to the motorist.

We have several objectives for the second year of the program, now well under way:

1. New reporting forms are being used to gather supplementary data not originally available;
2. A more concentrated effort will be made to expand the geographical coverage of the program by organizing additional REACT teams;
3. A greater effort will be made to publicize the program throughout the state and to those who may be traveling through;
4. Additional effort will be exerted to encourage the Federal Communications Commission to provide additional enforcement efforts to reduce interference on channel 9; and
5. The state director and district coordinators will be more involved in training and supervision of the teams to produce a higher level of monitor efficiency.

It is our hope to provide future reports showing how this basic program is being expanded to other states and eventually could result in an effective nationwide system for highway communications at almost no cost to the taxpayer.

ACKNOWLEDGMENTS

The authors wish to acknowledge the vital contributions of the following persons to this research project and to the development of this paper: Clifford Kimber and Rex Fleming, Ohio State Highway Patrol; Edward F. Weller, Head, Electronics and Instrumentation Department, General Motors Research Laboratories, and his staff members, Clark E. Quinn and William G. Trabold; and Gerald H. Reese, Managing Director, REACT National Headquarters. In addition, we acknowledge the invaluable efforts of all members of the State Highway Patrol and the thousands of REACT volunteers in Ohio.

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DISCUSSION

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In the past 25 years the use of highways by passenger vehicles, trucks, and buses has exceeded the highest forecasts made in the late 1940s. The growth of the suburbs, the decline of the railroads, and the extension of the middle class are all intricately interwoven with an explosion in the number of vehicles and miles of roadway.

Many feel that (for a variety of reasons) we are now entering a period of consolidation. More vehicles and more highways are creating more problems than they solve. Increasing efforts are being directed now toward alternative forms of transportation

and toward increasing the safety, efficiency, and convenience of existing highways and vehicles. It is this latter interest that has spurred the emergence of highway communications.

The very nature of highways and the use of vehicles exclude parochial systems. What is sauce for the New York motorist must be sauce for the Virginia motorist because he is likely to be the same individual in the same vehicle displaced only a few hours in time. Highway systems in general, but most certainly highway communications in particular, must be national in scope and specification. Hence, this is clearly a field for federal responsibility. The response, so far, has been timorous.

The paper by Chiaramonte and Kreer is well written and clearly explains the project that is being reported on and its antecedents. It provides valuable statistical data on the nature of the need for highway communications, and its conclusions are objective.

The paper also clearly demonstrates the effort that has been expended by REACT groups and shows them to be imaginative, dedicated, and civic-minded.

For the purposes of my remarks, Figure 3 shows the REACT system in operation, giving the flow of information from and to the motorist requiring assistance. From the statistical data provided in Figure 1, a majority of the motorists have been involved in accidents or require mechanical assistance. Also from the same figure, a majority of the CB-equipped monitors are either passers-by or REACT team members.

In the days of the Western frontier, new territories were peopled and functioned acceptably before government services caught up. Law and justice services were often ad hoc in nature during the early days of the wild west. This ad hoc justice was uneven and in many ways less than ideal, but it was better than nothing; it filled a vital need temporarily.

I believe this analogy fits the REACT approach to highway communications. It represents a tremendous improvement over no highway communications. It is filling a vital need temporarily because, as in the past, the government is slow in catching up.

However, it would, in my opinion, be a mistake to agree with the statement by the authors that CRS "offers a vast potential for an integrated nationwide system...." I feel more comfortable with their conclusion: "In spite of all the difficulties encountered, e.g., illegal operations, atmospheric phenomena, unpredictable coverage, and the irregularities inherent in a volunteer program, the Ohio REACT Emergency Network proves that a significant amount of highway emergency traffic and motorist assistance can be conducted on channel 9."

What then are the characteristics of a national highway communications system? Three basic criteria come to mind, and these in turn spawn a series of corollaries. The three criteria are as follows:

1. The system must provide two-way communications into (eventually) each motorist's vehicle;
2. Communications must be direct with the single agency that is responsible for the highway; and
3. The system must operate identically, without the necessity of switching, in all parts of the country.

Figure 4 shows such a system. Other crucial items that must be factored into system design are cost, limited spectrum, the laws of physics, and the realization that national systems do not descend on the country like a giant fishing net but rather evolve logically, growing here and there and finally merging into an overall system. With these factors in mind, the following major corollaries become obvious:

1. A single set of frequencies,
2. Digital plus emergency voice messages,
3. Low radio frequency power, and
4. Multiple use of links.

One system that meets these criteria has been designed and is currently undergoing tests on the Sagtikos Parkway (7). Table 3 gives a comparison of the performance of a national highway communications system with a volunteer emergency-monitoring system as described in the paper.

Figure 3. REACT system in operation.

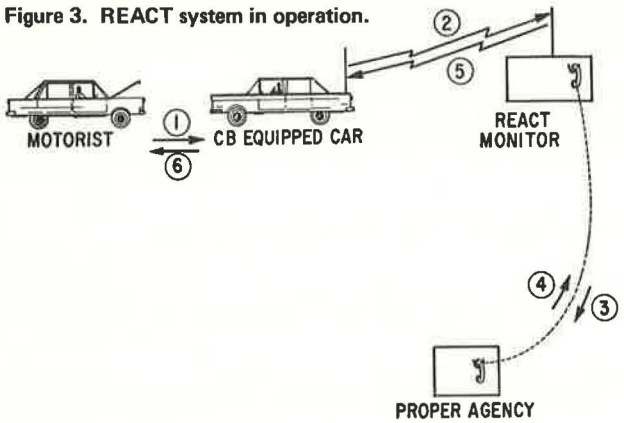

Figure 4. Operation of a national highway communications system.

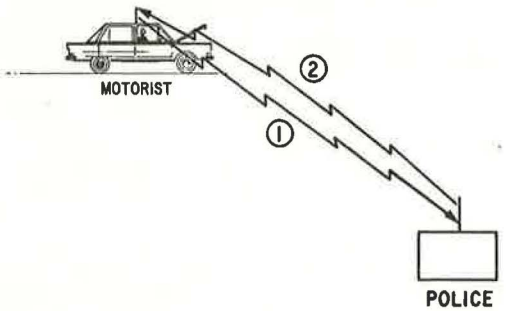

Table 3. Comparison of volunteer emergency-monitoring system and national highway communications.

Quality	Volunteer Emergency-Monitoring System	National Highway Communications System
Single national channel	X	X
Two-way communications	X	X
Communication type	Voice	Digital plus emergency voice
Decision-making	Volunteer	Professional
Response time	Statistical	Seconds
Interference	Significant problem	None

The authors and the thousands of REACT volunteers all deserve our gratitude for their initiative and dedication. It is my hope that these qualities coupled with their valuable experience can be harnessed to the evolution of a truly national highway communications system developed with strong federal support.

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The need for communication with motorists has been concluded in various studies and analyses conducted under government sponsorhip during the last decade. Collectively, the studies are diverse in subject and scope, covering many aspects of highway communication and ranging from the fundamental need to receive information to accident detection and location, reporting highway hazards, and coordination of public service agencies. In general, separate analyses have been made of systems that can satisfy one or the other requirements, and yet the system requires the composite if the full benefit is to be realized. Quantitatively, it has been estimated that fatalities can be reduced by 1,500, injuries reduced by 59,000, and reduction in delays by 160,000,000 hours by implementation of a motorist-aid communication system. It has been conservatively estimated that 50 to 75 percent of rural highway deaths need not have occurred if prompt and experienced emergency medical service had been available. Communication is an essential element in providing this service. Qualitatively, other benefits in reduction of chain-reaction accidents and better use of resources for law enforcement, national disasters, health services, and other public services will also derive. The message is clear: Motorist communications must be provided for safety and efficiency in highway travel, in addition to the other potential benefits to the American public.

The ultimate solution to the accident assistance problem lies in a system that will enable the motorist to summon assistance from his car and be warned of hazardous conditions before reaching the point of danger. The system should also provide automatic detection and location for accidents, even if vehicle occupants are unable to do so; vehicle-to-vehicle communication to warn of approaching ambulances, fire trucks, and the like; and the capability for the highway safety system to communicate at will with vehicles requiring assistance.

Electronic advances and state-of-the-art developments can now meet these needs. The crucial task of integrating these developments into an effective national system is more political, institutional, administrative, and managerial than technical. The need is clearly demonstrated by activity of volunteer citizen groups such as REACT, who, once given the means to communicate via two-way radio, have instinctively developed their own highway communication system.

It should be recognized that the CB radio service was used because it was available. CB was never intended to fully meet highway communications requirements. The enormity of the problem is staggering when one realizes that there are approximately 100 million registered vehicles; each year six million additional vehicles are manufactured, and the number reaching the roads exceeds those being retired. Although not directly applicable, approximately 10,000 new registered drivers reach the road system daily. It is apparent that lack of effective control noted in the REACT article is a major problem to be overcome. The experience and other lessons to be learned are of direct value and can be applied in the development of a national highway communication system.

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The Chiaramonte and Kreer paper discusses the importance and effectiveness of CB radio using volunteer monitors for motorist aid and information relative to other systems in operation today. They present data that indicate the viability of the system.

The object of this discussion is to add information on the subject of the Chiaramonte and Kreer paper. An examination of the status and activity in highway communication reveals that two systems are partially in operation. The first system employs call boxes located along expressways and is the result of research, planning, and evaluation by state and federal highway agencies. The second operating system makes use of CB radio and volunteer monitors who respond to motorists' requests for aid and information on several CB channels. This system developed spontaneously as the population of privately owned base station and mobile transceivers grew.

Several forms of call boxes, both radio and telephone, are in operation, and many others are in planning and procurement stages. An NCHRP report (8) indicates that approximately 5,700 call boxes have been installed by 12 states. Another 13 states have definite plans to install them by 1974. Installation of call boxes is limited almost exclusively to Interstate and other expressways. Call boxes are a practical, manageable, and proven means by which expressway motorists in need of aid can communicate their distress to highway authorities.

Call boxes do nothing, however, for motorists stranded elsewhere in the U. S. road system. Further, they are not an adequate source of traffic and road information for either civil agencies or the motoring public.

The use of CB radio by volunteers to achieve highway communication on a national scale is an accomplished fact. The CB-equipped motorist (estimated at 1.8 million vehicles, or one in every 55 vehicles) has recognized his need for both aid and information. Volunteer monitors achieve enough satisfaction in serving others to make the system work. Technically it is an inferior system, and management of it will never be complete in the sense that call-box systems can be managed.

The fact remains that CB radio is the most massive highway communications system in operation today. Renner's analysis (6) of the 1969 FCC CB survey data gives some estimation of the extensive use of CB radio. It estimates over 5.25 million emergency uses of CB in 1969. Over 4 million of these were for automobile trouble. Seventy percent of the licensees indicate CB is usable for their needs. This has been achieved without the investment of public money.

The Federal Highway Administration has also recognized the need for the communication of more information on a wider scale than call boxes can achieve and has funded Renner to devise a comprehensive radio-based system (9). Quinn presented a paper that defines a similar system (10). Many of the observations of both investigators recognize the same needs. It is neither failure to recognize the motorist's needs for communication nor an ability to find technical solutions that meet those needs that delays implementation of such plans; it is economics.

We have recently compiled data from the 1971 National Survey of REACT teams on their use of CB radio (11). A questionnaire was sent to 780 affiliated U. S. teams of which 388 or 50 percent responded. The response from Ohio teams was 11.9 percent of the U. S. total.

Data reveal that 88.9 percent of the respondents find that channel 9 is suitable for the communication of emergencies. The 12.1 percent of respondents indicating that channel 9 is hard or impossible to use came from widely scattered states. We conclude that, although some local areas have difficulties with interference (illegal), the channel is very usable on a national basis. As Renner pointed out, user education and local action by the FCC would do much to improve this situation.

Channel 9 is by no means the only channel being used for emergency communication. More than 42 percent of REACT groups monitor other channels as well, with channel 11 being the most popular alternate. There is strong correlation between community population and the monitoring of channels by REACT teams. As community size decreases, channel 9 use decreases, and channel 11 use increases.

Use of other channels is believed to be caused primarily by the lack of channel 9 activity in rural areas and FCC constraints on the use of channel 9, which prevents monitors from communicating with each other. The answer to greater usage of channel 9 in rural areas is increased use of dual-channel monitoring equipment. However, the REACT survey indicates that only 7.2 percent of REACT monitors have any form of dual-channel equipment. Motorists seeking assistance via CB radio are advised to try channels 9 and 11 first and then other channels up through 15.

Many REACT teams report that they have already established working relationships with civil agencies, especially law enforcement agencies. These relationships for the most part are unofficial. In the case of Ohio, an official relationship has been established with the Ohio State Highway Patrol. This is reflected in the data by 87.0 percent of the Ohio respondents reporting a working relationship with the state police as compared to 65.5 percent of all U. S. respondents reporting such a relationship.

REACT does not enjoy the full cooperation of all Ohio teams and their members, particularly as regards the submission of monthly log reports. FCC survey data reveal that not more than one-third of the CB calls handled by REACT monitors are reported. This computation is based on 17 emergency uses of CB radio per year per licensee times the number of Ohio team members. We argue that REACT monitors would experience more than the average number of events per year.

As Chiaramonte and Kreer indicated, there is no direct knowledge of hours monitored in Ohio. At this time we can only represent coverage of the state by team location. At present there are 78 operating REACT teams located in 52 of 89 counties (58.6 percent). Of these, teams in 27 of the 89 counties (30 percent) have shown consistently goodparticipation in the program.

CB radio and volunteer monitors are already operating on a large-scale national basis. This has come about through private initiative and good will. No public money has been used. Many REACT teams are establishing working relationships with civil agencies, especially state and local police. Thanks to the establishment of channel 9 as an emergency calling channel, 89 percent of REACT teams report that CB is usable to communicate emergencies.

The challenges that face REACT and other public-service-oriented CB radio groups are primarily managerial and motivational: How can intrateam and interteam cooperation be improved? How can monitors achieve a greater sense of satisfaction from their volunteer work? How can CB highway communications more effectively serve the needs of the motorist and civil agencies?

Technically superior and more manageable systems of highway communication than citizens radio have already been studied. We are anxious to see them realized. However, today there are many crisis demands on public money for more basic social needs such as education, poverty, crime, and environmental control. These needs compete strongly for available funds. Because of this competition, we feel that CB radio and volunteer monitors will continue to fulfill the bulk of the motorist-aid and information needs for some time to come.

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